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Datasheet for the decision of 24 November 2016

Case Number: T 1520/11 - 3.4.02

Application Number: 06112940.9

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Title of invention:
Frame system with heat spreader for a liquid crystal display device

Patent Proprietor:
GrafTech International Holdings Inc.

Opponent:
SGL Carbon SE

Headword:

Relevant legal provisions:
EPC Art. 123(2)
EPC 1973 Art. 56

Keyword:
Main request - added subject-matter - (no)
All requests - Inventive step - (no)

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Catchword:

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Case Number: T 1520/11 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 24 November 2016

Appellant: (Patent Proprietor)	GrafTech International Holdings Inc. 12900 Snow Road Parma, OH 44130 (US)
Representative:	Brand, Thomas Louis TL Brand & Co 17 Hanover Square London W1S 1BN (GB)
Respondent: (Opponent)	SGL Carbon SE Rheingaustrasse 182 65203 Wiesbaden (DE)
Representative:	Botzenhardt, Sandra SGL Carbon GmbH Werner-von-Siemens-Strasse 18 86405 Meitingen (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 5 May 2011 revoking European patent No. 1754993 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman R. Bekkering
Members: F. Maaswinkel
T. Karamanli

Summary of Facts and Submissions

I. The appeal lies from the decision of the opposition division dated 5 May 2011 revoking European patent No. 1 754 993. Against this decision the patent proprietor (appellant) has lodged an appeal and requested that the decision under appeal be set aside and that the patent be maintained in amended form according to the main request or auxiliary request filed with the statement setting out the grounds of appeal of 8 September 2011. Furthermore the appellant has filed an auxiliary request for oral proceedings.

II. With its letter of 30 August 2011, the opponent (respondent) has requested that the appeal be dismissed. The respondent has also filed an auxiliary request for oral proceedings.

With a further letter of 26 January 2012, the respondent has filed objections under Article 123(2) EPC, Rule 80 EPC, Article 84 EPC, Article 83 EPC and Article 56 EPC against the claims of the main request and the auxiliary request.

III. In a letter of 17 September 2012, the appellant has presented counter-arguments against the objections raised by the respondent.

IV. In a summons to oral proceedings pursuant to Rule 115(1) EPC sent on 15 July 2016 the board has invited the parties to oral proceedings to take place on 24 November 2016.

V. In a subsequent letter of 21 October 2016, the appellant has filed a set of claims according to a second auxiliary request.

VI. In a letter filed by telefax on 24 October 2016, the respondent presented further arguments in support of its objections of lack of inventive step.

VII. At the oral proceedings the appellant requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of claims 1 to 12 according to the main request filed with the statement of the grounds of appeal, or, as an auxiliary measure, on the basis of claims 1 to 6 of the first auxiliary request "5.00 pm" filed at the oral proceedings, or on the basis of claims 1 to 12 according to the second auxiliary request, filed as first auxiliary request with the statement of the grounds of appeal.

The respondent requested that the appeal be dismissed.

VIII. Reference is made to the following documents:

D4: WO 2005/038761 A

D7: US 2005/0007516 A

IX. Claim 1 according the main request reads:

"An image display device (10) comprising:
an image display panel (12);
a frame system (18) including:
(i) a rectangular perimeter framework (17) operatively engaging the image display panel, the frame system comprising a support member configured as a sheet positioned against the framework for mounting the panel; and

(ii) a plurality of heat sources (20) operatively engaging the framework;

characterized in that the frame system further comprises heat dispersion material (30) positioned substantially within the framework comprising at least one sheet of compressed particles of exfoliated graphite operatively engaging the framework in operative thermal contact with the heat sources the framework having an internal aperture to facilitate heat transfer and dissipation by the heat dispersion material and in which the heat dispersion material and the heat sources are positioned; and

wherein the frame system exhibits a support factor of less than about 375 mm-W/m°K, where the support factor is determined by multiplying the thickness of the support member in the frame system by its in-plane thermal conductivity".

Claim 1 according to first auxiliary request "5.00 pm" reads:

"An image display device (10) comprising:
an image display panel (12);
a frame system (18) including:
(i) a rectangular perimeter framework (17) operatively engaging the image display panel, the frame system comprising a support member configured as a sheet positioned against the framework for mounting the panel; and
(ii) a plurality of heat sources (20) operatively engaging the framework;
characterized in that the frame system further comprises heat dispersion material (30) positioned substantially within the framework comprising at least one sheet of compressed particles of exfoliated graphite operatively engaging the framework in

operative thermal contact with the heat sources the framework having an internal aperture to facilitate heat transfer and dissipation by the heat dispersion material and in which the heat dispersion material and the heat sources are positioned; and

wherein the frame system exhibits a support factor of less than about 150 mm-W/m°K, where the support factor is determined by multiplying the thickness of the support member in the frame system by its in-plane thermal conductivity,

wherein the image display panel (12) includes an image display side (13);

the perimeter framework includes a top, bottom, first side, and second side; and

the heat sources (20) comprise a plurality of electronic components operatively engaging the framework,

wherein the top, bottom, first side and second side of the framework (17) define an aperture and the plurality of electronic components are positioned substantially within the aperture,

wherein the heat dispersion material (30) substantially spans the aperture,

wherein the heat dispersion material (30) operatively engages the top, bottom, first side and second side of the framework (17)".

Claim 1 according to the second auxiliary request differs from claim 1 according to the main request in the first feature of the characterising portion (*underlined by the board*)

"...**characterized in that** the frame system further comprises heat dispersion material (30) positioned substantially within the framework between the heat sources and the support member and comprising...".

All requests include further dependent claims.

Reasons for the Decision

1. *Main request - claim 1*

1.1 *Article 123(2) EPC*

1.1.1 In its letter of 26 January 2012, the respondent has filed objections under Article 123(2) EPC, i.e. that the original patent application did not disclose a combined embodiment of a (rectangular) perimeter framework and a support member.

1.1.2 In a communication pursuant to Article 15(1) RPBA, annexed to the summons to oral proceedings, the board observed that the original patent application appeared to disclose two different and unrelated sets of embodiments:

- the embodiments shown in Figures 1 to 8 and elaborated in paragraphs [0093] to [0097] showing heat dispersion material arranged with a support member, but disclosing nothing about a framework, its aperture, or frame system;
- the embodiments shown in Figures 9 to 11 and addressed in paragraphs [0098] to [0105] showing an arrangement of heat dispersing material within a perimeter framework having an aperture, no support member being disclosed or referred to.

1.1.3 According to the appellant the embodiments of Figures 1 to 8 of the published patent application, when taken in context, did provide a proper basis for the claims. For instance, from the captions of these figures (e.g. see

paragraphs [0082] and [0085]) it was clear that these Figures only showed components of the display device and the optimised frame system of the invention. This was also evident from paragraph [0036] disclosing that the support member was positioned against the framework. Furthermore in paragraph [0017] it was disclosed that together, the framework and support member constituted a frame system in the conventional display panel. Therefore the components shown in Figures 1 to 8 were part of an image display device within the definition of claim 1.

With respect to Figures 9 to 11 the appellant argued that the disclosure in paragraph [0106] implied that these embodiments could be constructed with a support member, i.e. that according to the original disclosure the inclusion of a support member in these embodiments was an optional feature. Furthermore, during the oral proceedings the appellant, referring to paragraph [0103], argued that the cross supports (34) in Figure 10 could be identified as "support members" within the meaning of claim 1. Indeed these cross supports had the functionality of a support member since they had both a mechanical (by supporting the mounted LEDs) and a thermal function (necessarily spreading the heat generated by the LEDs). Finally, the cross supports (34) in Figure 10 had the shape of a sheet, i.e. a flat or plane shape.

As to the value of the support factor 375 mm-W/m°K the appellant referred to paragraph [0016] in which it was disclosed that a 2 mm sheet of aluminium had a support factor of 440 mm-W/m°K. The upper value of 375 mm-W/m°K in claim 1 had been chosen as a significantly lower value than this value for a 2 mm aluminium sheet, and hence was not arbitrary.

1.1.4 With respect to the cross supports (34) the respondent, while admitting that these did have a mechanical function of providing a mounting for the LEDs, contested the thermal function, since the patent application did not disclose anything in this respect for these cross supports. During the oral proceedings the respondent also put into question the relevance of the value of the support factor of less than about 375 mm-W/m°K in claim 1, since this was a completely arbitrary value without any technical effect and even included the value of zero (i.e. no support factor altogether).

1.1.5 The board observes that the embodiment shown in Figure 10 provides a fair basis for claim 1 according to the main request, since the individual features of this claim can be identified in this embodiment. This also applies to the feature "support member configured as a sheet" which, according to the appellant during the oral proceedings, was represented by the cross supports (34).

1.1.6 In accepting the appellant's view that these cross supports are configured as a sheet and that they necessarily have both a mechanical and a thermal function the board has taken note of the respondent's objection that the disclosure of this embodiment in paragraph [0103] is silent about the thermal properties of the cross supports. Therefore in the board's view, the last feature in claim 1 concerning the condition for the support factor of "less than about 375 mm-W/m°K" is interpreted with the proviso that:

- neither claim 1, nor paragraph [0103] in which the cross supports (34) are disclosed, include a value of the thickness of these supports representing the

"support member in the frame system"; in particular it is noted that while in Figures 1 to 8 the support members (40, 140) are depicted as massive plates totally enclosing the inner structure, in the embodiment of Figure 10 the cross supports rather have a ribbon-like shape;

- this paragraph also does not disclose anything about the material of the cross supports, therefore the in-plane thermal conductivity is unknown; and
- the value of 375 mm-W/m°K implies a value lower than a typical thermally highly-conductive material like aluminium of a 2 mm thick sheet.

1.1.7 In conclusion the board finds that claim 1 of the main request complies with the requirements of Article 123(2) EPC.

1.2 *Inventive step - Article 52(1) EPC and Article 56 EPC 1973*

1.2.1 In the decision under appeal the patent was revoked on the ground of lack of inventive step having regard to document D7 (considered as the closest prior art) and document D4. Document D7 discloses an LCD-device of a similar kind as the device addressed in the patent application. The patent proprietor/appellant acknowledges this document as a proper closest prior art. In particular, in D7 also the problem of power consumption and heat generation of the LEDs is discussed (*which, when driven in a "hold-type" mode, see [0026], suffer from power consumption, life shortening and causing blurring of the picture by dissipated heat*). In document D7, in order to reduce the heat problem it is proposed to "flash" the LEDS, see Figure 8.

1.2.2 According to the decision the image display device shown in Figure 5 of document D7 included a frame system including a rectangular framework (main support 114) and a plurality of heat sources (LEDs 134). The framework (114) had an internal aperture in which the heat sources were positioned. Furthermore, according to the decision, the feature "support member configured as a sheet against the framework" was identified as the reflective sheet (112), because "the reflective sheet 112 was necessarily configured as a self-standing sheet..." (see the passage at the bottom of page 6 of the decision).

1.2.3 In consequence the opposition division identified the following differences between the features of claim 1 and the image display device of document D7 (see page 7 of the decision):

(i) the frame system further comprises heat dispersion material comprising at least one sheet of compressed particles of exfoliated graphite;
(ii) said at least one sheet of compressed particles of exfoliated graphite operatively engages the framework in operative thermal contact with the heat sources;
(iii) the heat dispersion material is positioned within the internal aperture of the framework to facilitate heat transfer and dissipation by the heat dispersion material; and
(iv) the frame system exhibits a support factor of less than about 375 mm-W/ m°K, where the support factor is determined by multiplying the thickness of the support member present in the frame system by its in-plane thermal conductivity.

1.2.4 In its communication annexed to the summons to the oral proceedings, the board observed that document D7 did

not disclose any information from which it could be concluded that reflective sheet 112 would represent a support member of the type defined in claim 1, as argued in the decision. The board noted that rather, with reference to Fig. 5, document D7 disclosed in paragraph [0053] (p.4, lhc, l. 1-7) that the main support 114 comprised a stepped coverage face including "a securing part to which a plurality of optical sheets 108 is safely secured. A backlight unit, a diffusion plate 110, a reflective sheet 112, and a plurality of optical sheets 108 are disposed at the inner side layer of the main support 114". Hence the reflective sheet was part of a "sandwich" of sheets/plates mounted together in the main support 114 which, in the analysis in the decision under appeal, corresponded to the "framework" of the device defined in claim 1. In this embodiment in Figure 5 of D7 there was no independent "support member", but the "support" function was effected by the "securing part" in the main support 114 referred to in paragraph [0053], p.4, lhc, l.1.

1.2.5 However, in the embodiment of Figure 5 of D7 the main support 114 comprises a cross support which constitutes "a support member configured as a sheet" as defined in claim 1. The cross support of D7 is, however, integral part of the main support 114 and not "positioned against the framework" as required by claim 1. Hence, additionally to the differences (i) to (iv) identified at page 7 of the decision, the board sees the following further feature of claim 1 as distinguishing from the embodiment in Figure 5 of document D7:

(v) the support member being positioned against the framework.

1.2.6 Furthermore, compared to feature (ii) in prior claim 1, present claim 1 filed with the statement of the grounds of appeal includes the additional feature that the heat dispersion material is "…positioned substantially within the framework", therefore feature (ii), now labelled (ii') reads:

(ii') said at least one sheet of compressed particles of exfoliated graphite is positioned substantially within the framework and operatively engages the framework in operative thermal contact with the heat sources;

1.2.7 Addressing the technical problem arising from the subject-matter of claim 1 starting from the disclosure in D7, the respondent with respect to features (i), (ii), respectively (ii'), and (iii) has referred to page 8, penultimate and last paragraph of the decision under appeal, according to which the corresponding features aimed at improving the spatial homogeneity of heat distribution of the heat generated by the plurality of the point-like heat sources, and therefore, to avoid image deterioration caused by hot spots in an image display device as exemplified by the LEDs 134 in D7. This problem of heat generated and hot spots by LEDs in LCD devices was addressed in document D4, see paragraph [0006] and the solution, to include a heat spreader of exfoliated graphic material in order to reduce the heat difference, was also proposed in this document. According to the respondent, the skilled person, by implementing such a sheet in the image display device of D7, would arrive at the subject-matter of claim 1 in an obvious way.

With respect to the appellant's objections that D7 was silent about the properties of the reflective sheet 112

the respondent argued that a common material for such sheets was aluminium because of its high reflectivity. Clearly aluminium has also a high thermal conductivity. But even a sheet of metallised polymeric material such as referred to in the submissions made by Mr Smalc in paragraph 10 attached to the appellant's letter of 8 September 2011 would, because of its thickness of less than 0.2 mm and the metallisation layer, be in operative thermal contact with the heat sources.

In the opinion of the respondent, the further features (iv) and (v) addressed different, unrelated technical problems:

- the restriction of the support factor to values of less than about 375 mm-W/m°K as in feature (iv) was arbitrary and did not provide any technical effect which was also manifest from the embodiment of Figure 10, in which neither the material nor the thickness of the cross supports (34) was disclosed; in any case such a value, or even a value of 150 mm-W/m°K as in claim 1 according to the first auxiliary request, was far above a value resulting from e.g. a typical support member made of steel, having a value of 40 mm-W/m°K, see paragraph [0036] of the patent application;
- the feature (v) defining that the cross support, i.e. the support member, was positioned against the framework instead of being an integral part of it as in the framework 114 in Figure 5 of D7, did not contribute anything to inventive step, because it was a constructional equivalent and was not related at all to the problem of avoiding image deterioration caused by hot spots.

1.2.8 Referring to paragraphs [0019], [0022] and [0024] of the published patent application, the appellant has

argued that the problem addressed in the invention was the provision of a display device which comprised a reduced size support member while still exhibiting the necessary mechanical support and effective heat dissipation, thereby optimising the frame system of the device. This problem was not addressed or even referred to in document D7 which was related to the provision of a liquid crystal device of reduced thickness and weight, see paragraph [0003] of D7. In this document the further problem of an improved display reliability and life span caused by heat generated by the LEDs was solved in a completely different way to the solution provided by the present patent, i.e. through the use of a "flashing method", see paragraph [0064] of D7. Hence, the heat problem being solved, the skilled person would not have an incentive to seek for other means to improve the panel reliability, at least not without hindsight. Thus there was no reason why the skilled person would combine the teachings of document D4 with the one of D7.

In particular the differences between the display panel from D7 and the claimed device would require the following steps to be taken:

- the device of D7 did not have a support member configured as a sheet and positioned against the framework;
- since the cross support in the framework 114 was integral part of the framework and therefore had the same thickness (molded structure) the skilled person would not be motivated to reduce its thickness since a reduction of the thickness of the framework would be detrimental to its mechanical stability and reduction of the thickness of the cross support would cause sagging;

- therefore a reduction of the support factor of the frame system to a value of less than about 375 mm-W/m°K was not disclosed or suggested, since a reduction of the thickness of the support member was not suggested;
- D7 was not concerned with the provision of heat dispersion material, since the heat problem was already solved (by flashing);
- in particular the provision of a sheet of compressed particles of exfoliated graphite operatively engaging the framework in operative thermal contact with the heat sources was not suggested, since in the embodiment of Figure 5 of D7 a reflective sheet 112 was positioned between the heat sources (LEDs 134) and the main support 114. The document did not disclose anything about the thermal properties nor about a thermal contact of this reflective sheet.
- In any case, because of the particular arrangement in Figure 5 of document D7 with a reflective sheet arranged between the heat sources and the main support the skilled person would not know where to position a heat dispersion sheet in this arrangement.

1.2.9 The appellant argued that the problem originally addressed in the invention was the provision of a display device comprising an optimised frame system by reducing the size of a support member while still exhibiting the necessary mechanical support and effective heat dissipation. According to the appellant, document D7 did not relate to this problem, but rather addressed the issue of an LCD device of reduced thickness and weight.

1.2.10 The board acknowledges that the introductory paragraphs of the published patent application, see e.g. [0015] - [0019], explain the motivation for optimising the weight of the frame system in prior art display devices by ways of reducing (or even eliminating) a support member in the frame. However, in the discussion of inventive step this original, subjective, problem may only be considered inasmuch the technical features of the independent claim unambiguously reflect such a teaching. Since this apparatus claim seeks protection for an image display device having the combined technical features defined in this claim, its subject-matter must be verifiably new and inventive over all prior art image display devices. In the present case, the first instance had started its analysis of inventive step on the basis of document D7 as the closest prior art, and the parties have confirmed that the disclosure in this document forms a proper starting point.

1.2.11 As set out in points 1.2.3 - 1.2.6 supra, the subject-matter of claim 1 according to the main request differs from the image display device shown in Figure 5 of document D7 in the features (i), (ii'), (iii), (iv) and (v). From these features, features (i), (ii') and (iii) define the presence of a particular heat dispersion material and its arrangement in the display device.

Features (iv) and (v) define properties of the support member, relating to an upper limit value of the support factor and its positioning within the framework.

1.2.12 The board concurs with the respondent's argument that features (i), (ii') and (iii) on the one hand, and features (iv) and (v) on the other hand address different technical problems. In particular features

(i), (ii') and (iii) are related to improving the heat distribution produced by the light sources in the display device; and features (iv) and (v) define constructional and thermal properties of a support member.

1.2.13 The appellant has disputed that the skilled person, starting from document D7, would have had a motive to improve the heat distribution in the device since by flashing the LEDs the heat problem had already been solved, referring to paragraph [0064] of D7. The appellant also emphasised that the objective disclosed in paragraph [0003] of this document was different from that of the patent in suit, namely the provision of an LCD module and driving method that reduced the thickness and weight of the module and lead to an improved picture quality.

Concerning the appellant's reference to paragraph [0003] of document D7 the board understands that this object addressed in document D7 relates to the prior art displays in this document, illustrated in Figures 1 to 4 of D7. However, as a proper springboard for a possible further improvement of the liquid crystal device of document D7 the skilled person rather will consider the embodiment in Figure 5 of D7, since in this embodiment the object referred to in paragraph [0003] is addressed and the improved display module is disclosed.

Furthermore, the board does not concur with the appellant's argument that improving the heat distribution in the device of D7 would not be an issue considered by the skilled person. The board notes that by the flashing driving method of the LEDs the blur phenomenon referred to in paragraph [0061] of D7 is

prevented. In paragraph [0064] the document discloses that by employing the flashing method the heat generated from the LED is reduced. However, depending on the fractional "ON" or T1-time compared to the total frame period (see Figure 8 and also paragraph [0063]), the LEDs will still produce heat. And as a negative consequence of substantially reducing the T1-time compared to the "OFF" time the brightness provided by the backlight unit will invariably be reduced in the same proportion. Therefore the skilled person understands that, depending on the actual operation conditions of the liquid crystal device shown in Figure 5 of D7, it would be desirable to further reduce the heat produced by the light sources.

1.2.14 The board concurs with the respondent that the skilled person, wishing to further reduce the heat generated by the LEDs in the display device of document D7 in order to prevent breakage of the LEDs, preventing a reduction of their lifespan and preventing blurring of the display, would find the solution of this problem in document D4, which discloses a heat spreader for PDP, LCD, and LED type display devices, see paragraph [0001]). In particular paragraph [0006] of this document addresses the very same problem of hot spots limiting the effectiveness or life of these devices as in document D7.

1.2.15 According to D4, e.g. see Abstract and paragraph [0025], the problem addressed in paragraph [0006] can be solved by providing a heat spreader comprising a sheet of compressed particles of exfoliated graphite having a surface area greater than the surface area of that part of the back surface of the display device where a localized region of higher temperature is generated. Accordingly, in the embodiment shown in

Figure 5 of document D7, since the LED array 130 is a two-dimensional array spanning virtually the whole inside area of the main support, the heat spreader should have the same surface area. Furthermore, according to paragraph [0086] of document D4, the heat spreader should be in operative contact with the display panel, viz. the light sources.

1.2.16 In the display module in Figure 5 of D7 reflective sheet 112 is arranged at the rear side of LED array 130. The appellant has objected that document D7 was silent about the properties of this reflective sheet. In this respect the respondent has argued that a common material for such sheets was aluminium, which had a high reflectivity and at the same time a high thermal conductivity. The board concurs with this argument and also with the further argument of the respondent that alternative reflective sheets, such as sheets made of metallised polymeric material referred to in the submissions made by Mr Smalc, because of their thickness of less than 0.2 mm and the metallisation layer, would be in operative thermal contact with the heat sources.

1.2.17 Therefore, in order to improve the heat spreading of the LED light sources array, the skilled person would include in the display module of Figure 5 of D7 a heat spreader comprising a sheet of compressed particles of exfoliated graphite (*feature (i) of claim 1*) of the same surface area as the array. He would position this spreader sheet at the rear of reflective sheet 112 since this is the only feasible position, i.e. between reflective sheet 112 and the main support 114. These parts would be, together with the further parts 102, 106, 108 and 110 "sandwiched" in the securing part of the main support 114, i.e. the framework (see paragraph

[0053]), and within the internal aperture of the framework (*feature (iii) of claim 1*). By virtue of this sandwich-arrangement the sheet of compressed particles of exfoliated graphite would be positioned substantially within framework 114 and, via the reflective sheet 112, operatively engage the framework in operative thermal contact with the heat sources 130 (*feature (ii') of claim 1*).

Hence, by addressing the problem of further preventing excessive heating of the LEDs which would cause a reduction in their life and also would cause blurring the skilled person would, in following the teaching of document D4 by way of including a heat spreader of compressed particles of exfoliated graphite, solve this problem.

1.2.18 As set out before, features (iv) and (v) in which the subject-matter of claim 1 differs from the device in Figure 5 of D7 define constructional and thermal properties of a support member.

With respect to feature (iv) according to which the support factor is limited to less than about 375 mm-W/m°K, this feature is interpreted with the proviso set out in point 1.1.6 *supra*. In this sense the board has taken note of the respondent's argument that a framework and support member of steel would, with a reasonable thickness of ≤5 mm, exhibit a support factor below the value of 375 mm-W/m°K. Furthermore, it is noted that the main support in the embodiment of Figure 5 of D7 is made of molded material (paragraph [0053]) which frequently consists of plastics generally having very low in-plane and through-plane thermal conductivity. Such a molded plastics main support would be clearly suitable at least for smaller display such

as for mobile phones. In this case, assuming a thickness of the main support 114 and its cross member of below 10 mm, this main support would have a support factor far below the maximum value of the support factor in claim 1 (*feature (iv)*).

Finally with respect to feature (v), which defines that the support member is positioned against the framework, the board concurs with the respondent that this feature merely represents an alternative to the situation in Figure 5 of D7, where the cross support is integrated in the main support 114, both being molded together. In particular the board does not see any synergy effect between this feature and the further features of the claim, and it does not contribute to the solution of the technical problem by features (i), (ii') and (iii).

1.2.19 In summary, recapitulating the arguments of the appellant during the oral proceedings:

- "the device of D7 did not have a support member configured as a sheet and positioned against the framework"; the board finds that the cross support as part of the main support 114 does have the shape of a sheet (*in the terms of the appellant: a flat or plane shape*), the feature of its positioning merely includes a well-known technical alternative which the skilled person will select according to the particular situation;
- "since the cross support in the framework 114 was integral part of the framework and therefore had the same thickness (molded structure) the skilled person would not be motivated to reduce its thickness since a reduction of the thickness of the framework would be detrimental to its mechanical stability and reduction of the thickness of the cross support would cause sagging"; as the board

has explained in point 1.2.10 *supra*, the "reduction" of the thickness of the framework or the support member is not a technical feature of claim 1;

- "therefore a reduction of the support factor of the frame system to a value of less than about 375 mm-W/m°K was not disclosed or suggested, since a reduction of the thickness of the support member was not suggested"; as expressed *supra*, a "reduction" is not a technical feature of claim 1. Furthermore the board concurs with the respondent that a typical support factor for a steel framework, and in particular for a molded plastics framework, is substantially below the value of 375 mm-W/m°K;
- "D7 was not concerned with the provision of heat dispersion material, since the heat problem was already solved (by flashing)"; as set out before, the board is of the opinion that flashing may reduce the heat problem, but that there may remain heat spots, in particularly if the ratio "OFF" and "ON"-times of the LEDs cannot be strongly reduced, because of brightness requirements of the backlight unit;
- "in particular the provision of a sheet of compressed particles of exfoliated graphite operatively engaging the framework in operative thermal contact with the heat sources was not suggested, since in the embodiment of Figure 5 of D7 a reflective sheet 112 was positioned between the heat sources (LEDs 134) and the main support 114. The document did not disclose anything about the thermal properties nor about a thermal contact of this reflective sheet"; the board finds, in accordance with the argument by the respondent, that a reflective sheet out of the commonly used

reflective material of aluminium, or the other thin metallised films referred to by Mr Smalc, does provide an operative thermal contact with the heat sources;

- "In any case, because of the particular arrangement in Figure 5 of document D7 with a reflective sheet between the heat sources and the main support the skilled person would not know where to position a heat dispersion sheet in this arrangement"; as set out before, a heat dispersion material sheet applied as recommended in paragraph [0086] of document D4 "in operative contact with the panel" can only be positioned at the back of reflective sheet 112.

Therefore the board finds that these arguments by the appellant are not persuasive.

1.2.20 Hence the subject-matter of claim 1 according to the main request does not involve an inventive step.

2. *First auxiliary request "5.00 pm"*

2.1 Admission - Article 13 RPBA

According to Article 13(1) RPBA, any amendment to a party's case after it has filed its grounds of appeal may be admitted and considered at the board's discretion. The discretion shall be exercised in view of inter alia the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy.

2.1.1 The present first auxiliary request "5.00 pm" of the appellant was filed during the oral proceedings before

the board. Thus it is an amendment to the appellant's case within the meaning of Article 13(1) RPBA and, accordingly, it lies within the board's discretion to admit this request into the appeal proceedings.

2.1.2 The respondent requested that *first auxiliary r*equest *"5.00 pm"* be not admitted into the appeal proceedings under Article 13 RPBA since this request could have been filed at an earlier stage of appeal proceedings and gave rise to a new factual situation. There was also no justification for the appellant to file a combination of features from several claims at this late stage of proceedings. Moreover, not all amendments in the claims were a reaction to the previous discussions.

2.1.3 According to the appellant, in claim 1 essentially the features of claims 1, 2, 3, 9, 10 and 11 of the main request were combined and thus the filing of auxiliary requests "5.00 pm" did not create a new factual situation. Moreover, there was a clear basis for claim 1 of first auxiliary request "5.00 pm" in the embodiment of Figure 10 and in the dependent claims of the application as filed. Therefore, the request did not raise new complex issues and should be admitted into the appeal proceedings.

2.1.4 The board considered that first auxiliary request *"5.00 pm"* did not create a new complex situation, because the added features in its claim 1 were taken from claims 2, 3, 9, 10 and 11 of the main request, which correspond to granted claims 2, 3, 10, 11 and 12, respectively. Therefore, the board, exercising its discretion under Article 13(1) RPBA, admitted first auxiliary request *"5.00 pm"* into the appeal proceedings.

2.2 *Article 123(2) EPC*

2.2.1 The respondent submitted that the perimeter framework, now included in claim 1, was only disclosed in the embodiment of Figure 10, and that a combination of this feature with other features from dependent claims would be problematic.

2.2.2 According to the appellant, the basis for claim 1 was in the embodiment of Figure 10 and in the dependent claims of the application as filed. In this embodiment the electronic components now defined in claim 1 were represented by the LEDs. In particular, the value of the support factor of less than about 150 mm-W/°K had been defined in original claims 3 and 17. Also the dependent claims of this request had their counterparts in the originally filed claims. Therefore the present request was not objectionable under Article 123(2) EPC.

2.2.3 The board finds the appellant's arguments convincing and concludes that claim 1 of the first auxiliary request "5.00 pm" complies with the requirements of Article 123(2) EPC.

2.3 Inventive step - *Article 52(1) EPC and Article 56 EPC 1973*

2.3.1 In support of its arguments relating to inventive step, the appellant stated that the technical problem addressed in claim 1 was the provision of an optimised frame system for a display device. The claimed subject-matter was not obvious having regard to the combined disclosures in documents D7 and D4. In particular the skilled person would not have had a motivation for reducing the thickness of the cross support in the embodiment of Figure 5 in document D7 in order to

obtain a support factor of less than about 150 mm-W/°K, since this would, for instance, imply to reduce the thickness of an aluminium sheet to less than 0.7 mm. The information in document D7 that the main support was molded did not exclude selecting a metal, e.g. aluminium, for this part, since many display screens had molded main supports made out of metals. Therefore the feature "molded" in document D7 did not allow drawing any conclusions about the material of the main support.

Furthermore according to document D4 the heat dispersion material had to be applied at the back surface of the display device with the aim of reducing the heat difference between the hot spots and adjacent locations, see paragraph [0072] of this document. Therefore D4 disclosed that the material was only applied at an area approximately greater than that of one LED, but not spanning the whole aperture of the framework as defined in claim 1. The appellant repeated that document D7 did not disclose or suggest the use of a heat dispersion material at all.

2.3.2 The respondent repeated its assessment that a value of the support factor of 150 mm-W/m°K was completely arbitrary, similar as the value of 375 mm-W/m°K in claim 1 according to the main request. In any case, even a cross support out of metal would have such an approximate value, since steel had a value of 40 mm-W/m °K, see paragraph [0036] of the patent application.

2.3.3 Having regard to the additional features of claim 1 of the new first auxiliary request the board finds that these relate to the following aspects:

(a) the frame system exhibits a support factor of less than about 150 mm-W/m°K;
(b) the image display panel includes an image display side; the perimeter framework includes a top, bottom, first side, and second side; the heat sources comprise a plurality of electronic components operatively engaging the framework; the top, bottom, first side and second side of the framework define an aperture; and the plurality of electronic components are positioned substantially within the aperture;
(c) the heat dispersion material substantially spans the aperture and operatively engages the top, bottom, first side and second side of the framework.

2.3.4 With respect to feature (a) the board refers to its position set out in point 1.2.18 *supra* where it is found that a main support 114 in the embodiment of Figure 5 in document D7 made out of molded material would, in case of e.g. plastics, have a support factor well below 375 mm-W/m°K. The board also notes that the image display device defined in claim 1 does not define any minimum restrictions for the size of the display device. Therefore the protection sought should also apply to smaller display devices, such as pocket calculators and mobile phones, which, of course, also applies to the device in figure 5 of document D7. In such cases a typical thickness of the securing part in the main support 114 may well be 1 mm, if made out of steel. In this case, the resulting support factor would be approximately 40 mm-W/m°K, also this value being substantially smaller than the value of 150 mm-W/m°K defined in the claim. The board therefore finds that claiming this value of "less than about 150 mm-W/m°K" without at the same time posing further restrictions

(thickness of the sheet material or its composition) will, in many cases, result in display devices exhibiting similar or even lower support factors, depending on the particular sheet thicknesses and materials used. In conclusion, the value of the support factor "less than about 150 mm-W/m°K" must be regarded as a typical value and does not contribute to inventive step.

2.3.5 The feature (b) defines typical properties of prior art display devices. Indeed the embodiment in Figure 5 of document D7 also shows the components summarised in this feature (b), wherein the heat sources, viz. the plurality of electronic components, are formed by the LEDs (see also the appellant's argument in point 2.2.2 *supra*).

2.3.6 Feature (c) defines further details of the arrangement of the heat dispersion material within the framework (*spanning the aperture, and operatively engaging the framework*). The appellant has argued that document D4 does not disclose this nor hints at anything in this direction.

The board, however, has set out in point 1.2.15 *supra* that the skilled person, when including the heat spreader disclosed in document D4 in the embodiment of Figure 5 of D7 and following the instructions in document D4, would automatically include a heat spreader with the same surface as the LED array 130, which spans the whole inside area of the main support. Since the parts of the display panel in this embodiment of document D7 are "sandwiched" in the main support 114, the heat spreader sheet would operatively engage the framework, including its sides (see also point 1.2.17 *supra*).

2.3.7 Therefore the subject-matter of claim 1 according to the first auxiliary request does not involve an inventive step.

3. *Second auxiliary request*

3.1 This request had been filed as first auxiliary request with the statement of the grounds of appeal. During the appeal proceedings, its admissibility into the proceedings was not put into question by the respondent.

3.2 Inventive step - *Article 52(1) EPC and Article 56 EPC 1973*

3.2.1 In claim 1 of this request the positioning of the heat dispersion material within the framework is further specified to be between the heat sources and the support member. In support of this request at the oral proceedings the appellant argued that the purpose of this arrangement was to provide a registration between the LED heat sources and the support member. The appellant also argued that document D7 was not concerned with the problem addressed in the present invention of reducing the weight of an image display device, nor did it disclose a support member configured as a sheet positioned against the framework for mounting the panel.

3.2.2 The board does not concur with these arguments: as set out in point 1.2.17 *supra*, the skilled person would position the heat spreader sheet in the display module of Figure 5 of document D7 between the reflective sheet 112 and the main support 114, i.e. between the heat

sources, (the reflective sheet 112) and the support member.

3.2.3 Insofar as the appellant asserts that, contrary to the disclosure of document D7, the invention would include a "registration" between the heat sources (LEDs) and the support member, it is noted that no such "registration" is included in the claims; nor is it found in the patent application as filed.

3.2.4 The board also does not concur with the argument that in document D7, the support member (*i.e. the cross member of main support 114*) was not for mounting the panel. Rather, because of the "sandwich" arrangement (see also point 1.2.17 *supra*), the function of this cross member is also to enable mounting the panel.

3.2.5 Therefore the subject-matter of claim 1 according to the second auxiliary request does not involve an inventive step.

4. Hence, none of the appellant's requests is allowable. Therefore, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl R. Bekkering

Decision electronically authenticated